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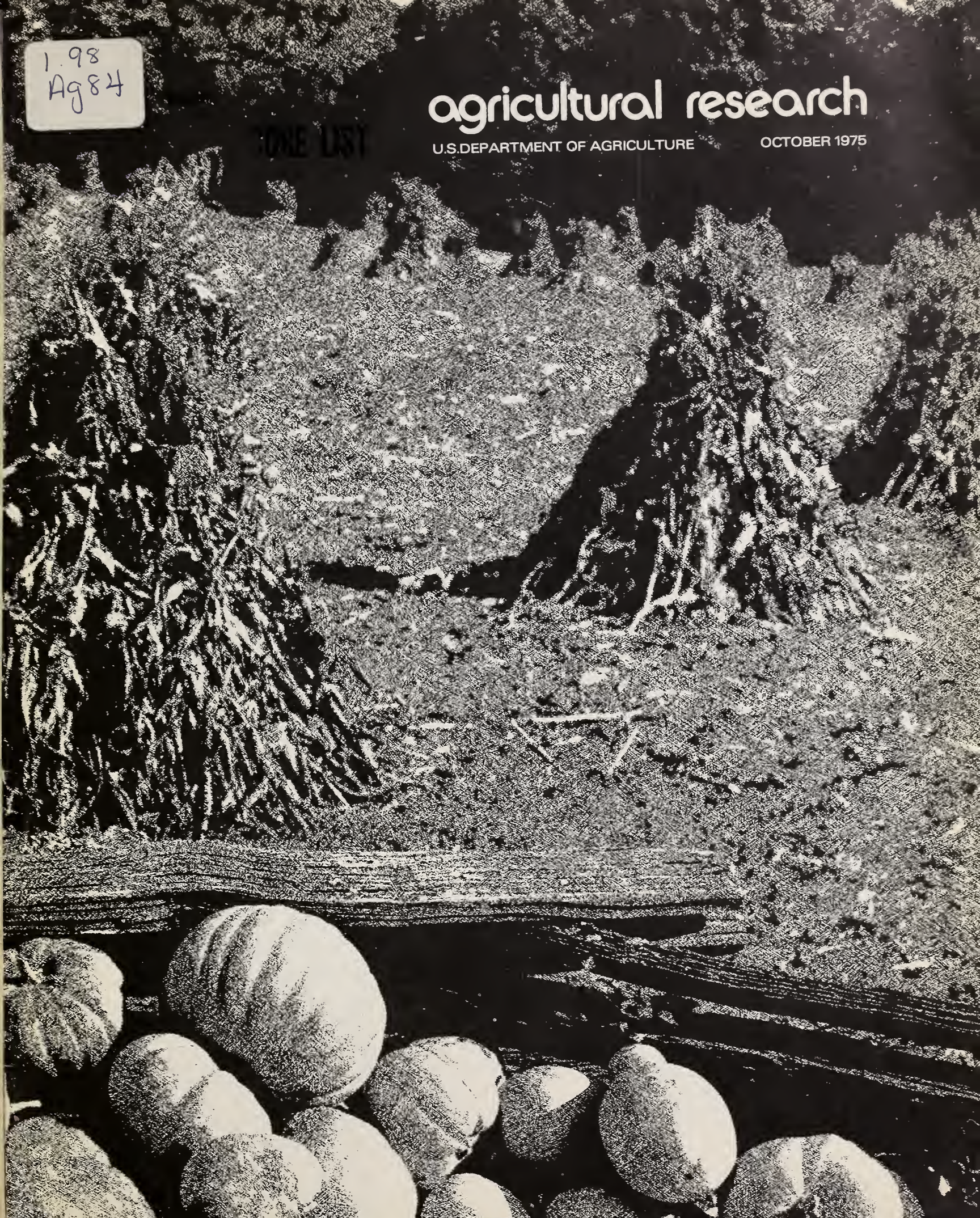

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Ancient and Delectable

Man has always known the pig. For millenia early man knew him as a formidable foe to be spear-hunted for meat or to prevent the rooting up of his little patches of crops. Then somewhere along mankind's evolutionary road, probably in Mesopotamia and Egypt, Neolithic man tamed the wild tusker and became a breeder of swine. Ever since, the pig's ready adaptability to diverse lands, climes, and feeds has earned him recognition as an esteemed and versatile source of toothsome meat. As swine husbandry spread throughout the Old World, pork gained an eminent place in commerce.

Brought to the mainland by Spanish explorers, the pig soon loomed large in colonial agriculture. At first, settlers of the Atlantic Coast allowed their swine to forage the woods for mast and roots, with a few confined in pens to omnivorously convert farm and home wastes. In time, swine husbandry reached the Midwest and on these fertile lands corn and hogs became permanent inseparables. Indeed, the humble pig's ability to quickly and efficiently convert corn and other feedstuffs to marketable meat soon won him the well-known title of "mortgage lifter."

Pork has always been a staple of the American diet. Today it accounts for about 30 percent of the meat we eat, and is our third largest source of animal protein. Past progress in swine production has been good, but to pause in a fast changing world is to invite retrogression. Accordingly, agricultural scientists are engaged in a broad research effort to continually improve the production, marketing, and quality of pork.

Real progress has been made, for example, in swine breeding and genetics. Through years of selective breeding, scientists have developed swine that produce less lard and more meat. A long-term experiment at Beltsville confirms that leanness and body length can be rapidly altered by selection based solely on backfat thickness. Related studies show that low-fat type hogs are more efficient than fat-type hogs in converting high-protein rations into lean meat.

Over the years, animal scientists have also registered significant research advances in such varied fields as estrus control, artificial insemination, identification of nonconceiving sows, swine nutrition, efficiency of feed utilization, and swine health. Success in these and other areas of research reduces swine production costs, which ultimately benefits consumers. Science will further enhance the position of pork, that age-old and delectable nutriment.

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COVER: *October glory. The classic harvest scene has vanished from today's countryside, now characterized by sweeping fields of corn stalks and huge combines, corn pickers, and stereo-equipped tractors (N–3150).*

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U.S. Department of Agriculture

Talcott W. Edminster, Administrator
Agricultural Research Service

Using a new four-electrode device, scients are able to make quick, easy soil salinity measurements in the field. Soil scientist Robert J. Prather adjusts a meter used to measure the resistance of electrical flow between the inner pair of electrodes (PN-4108).

Quick,easy soil salinity measurements

One of the more important chores in the life of an agricultural water manager in the proper management and treatment of saline soils is getting accurate information of the concentration and extent of soluble salts in such soils.

Eyeballing crops and soils in such areas is not enough since salinity may reduce crop yields by as much as 25 percent without visible symptoms.

ARS researchers at the U.S. Salinity Laboratory, Riverside, Calif., have developed two devices that may make life just a bit easier for those charged with keeping salinity down to manageable levels. The devices may one day play a part in reducing or preventing farm income losses from salinity as well as aid in preventing environmental pollution.

Both devices are adaptations of earth resistivity techniques that have been in use for years by geophysicists to determine depths to subsurface strata and ore bodies. The technique involves the measurement of resistance between electrodes placed on the soil surface.

To date, the reliable diagnosis of salinity has required tests on soil samples that are brought into the laboratory, although less precise measurements may be made in the field with portable field kits.

Even with portable kits, the time and effort required for such procedures are considerable because of the numerous samples that must be taken throughout the field and at varying depths in the profile.

Further, to evaluate the effects or success of various management programs and treatments, it is desirable to monitor soil salinity levels periodically.

It all boils down to present methods taking too much time, effort, and money. For those reasons, a method for determining soil salinity directly in the field without recourse to sampling and analysis should be invaluable both for practical and research applications.

Soil scientist James D. Rhoades and chemist Robert D. Ingvalson have measured soil salinity in the field with

Researchers at Riverside have also developed a single-probe device for taking spot readings of salinity. That device has the four electrodes inlaid in a single shaft (the four metal rings in the photo above, PN–4109), which can be inserted in a standard soil sampler hole (below, PN–4110).

a device which relates soil electrical conductivity (EC) to soil salinity.

Soil EC measurements are made using four electrodes, equally spaced along a straight line, inserted a few centimeters into the soil surface. Electrical current is passed through the outer pair of electrodes. The current flows through the soil via electrolyte conduction. Resistance to this current flow is measured between the inner pair of electrodes with a resistance meter. Precalibration of the meter relates resistance to soil salinity.

For a given soil type, researchers are able to correlate soil conductivity with soil salinity when such measurements are made at a constant water content. For the study, Dr. Rhoades used field capacity—the moisture content of the soil a day or two after a rain or irrigation treatment—as the water constant because that constant is easily reproducible and available.

A major benefit of the technique is its ability to measure average salinity in a relatively large volume of soil. Depth or volume of the sample can be regulated by increasing or decreasing the spacing between electrodes.

Since plants respond to the salinity of the large soil mass in which their roots grow, the four-probe device lends itself to practical salinity measurements.

Soil salinity is typically highly variable from spot-to-spot in the field; hence, many soil samples would have to be analyzed in a laboratory to come up with similar readings that take only moments with the EC technique.

Among benefits of the method are:

The lack of need of taking soil samples or making analytical determinations.

The speed and simplicity of the measurement.

The low cost of the required equipment.

The portability and suitability for diagnosis, survey work, or monitoring of salinity.

Dr. Rhoades in cooperation with ARS soil scientist Ardell D. Halvorson, Sidney, Mont., used the four-probe device to survey and map areas of low, medium, and high salinity with good results in their regional studies of saline seeps. Ordinarily such a project would involve time-consuming soil sampling and expensive laboratory analysis.

Since there are times when precise information on soil salinity distribution within the rootzone is needed, Dr. Rhoades in cooperation with Jan van Schilfgaarde, Director of the Salinity Laboratory, only recently developed a four-electrode probe that gives "spot" readings of salinity rather than the large volume readings of the initial device.

The newer four-electrode probe works on the same principle except the electrodes are inlaid in a single shaft so that the probe can be inserted to the desired depth in a hole made with a standard soil sampler. The leads from the electrodes are inside the probe's shaft and exit out the handle to a resistance meter. The shaft is slightly tapered so that firm contact of all four electrodes is achieved upon insertion in the soil.

Studies continue to evaluate the use of the technique at differing water contents under field conditions. Dr. Rhoades is developing a salinity monitoring program in cooperation with local Soil Conservation Service and Bureau of Reclamation personnel in the Wellton-Mohawk Valley of Arizona, involving the new devices to detect any excessive increases in soil salinity that may result from underirrigation or changes in irrigation procedures. Methods for ascertaining the status of salinity reclamation are being developed in the Imperial Valley by Dr. Rhoades and soil scientist Malek Kaddah employing these same devices. □

New wheat provides valuable protein

If the new hard red winter wheat variety Lancota were grown on all of Nebraska's wheat acreage, it would provide about 100 million more pounds of valuable protein each year than present varieties do.

Best of all, says ARS agronomist Virgil A. Johnson, the protein is in that portion of the wheat grain that is made into white flour, so it will not be lost in the milling process.

Lancota is a result of a cooperative effort begun more than 20 years ago by ARS and the Nebraska Agricultural Experiment Station, Lincoln, to improve the nutritional value of wheat by breeding. Dr. Johnson predicts that its development may be only the first step in genetic engineering to make wheat a more nutritious food (AGR. RES., March 1974, pp. 6–7).

Eventually, this research may contribute significantly to the nutritional status of about a third of the world's people who depend upon wheat as a major source of calories and protein.

The new wheat is a selection from a cross made in 1965 of an Atlas 66-Comanche breeding line and the variety Lancer. It derives its higher grain protein content from Atlas 66, a soft wheat carrying genes for high protein from the South American variety Frondoso.

Lancota is the first hard winter wheat variety adapted to the Great Plains with the potential for high yields of grain possessing 10 to 20 percent more protein than ordinary wheat varieties. The additional protein will cost consumers and farmers little or nothing, Dr. Johnson points out, because it is built into the wheat plant. And it does not depend upon the use of additional nitrogen fertilizer.

Like any other new variety, Lancota must initially gain farmer acceptance on the basis of its agronomic qualities, Dr. Johnson explains. Farmers presently have limited market incentive to grow a higher protein variety, but they may plant it if it equals or excels currently grown varieties in yield, disease resistance, and other field characteristics.

Lancota has qualities in addition to its high protein potential that may make it attractive to farmers, millers, and bakers, he says.

It has been consistently superior to its male parent, Lancer, in yield and equal or better in bushel weight in performance tests. It is similar to Lancer in field appearance and stem-rust reaction but much superior in resistance to leaf rust and Septoria leaf blotch. Like Lancer, it is medium in maturity but is somewhat less winterhardy.

The new variety has excellent milling and baking qualities. It is medium in dough mixing time, has good mixing tolerance, and excellent loaf volume potential.

The Nebraska, South Dakota, Kansas, and Texas Agricultural Experiment Stations and ARS joined in the release of Lancota. Limited quantities of certified seed should be available for 1976 planting. □

A potent weapon against stored grain insects

Gamma irradiation could be a potent weapon in the battle to keep the bugs out of stored grain products like wheat, corn, and rice. Of potential commercial importance, it would also avoid the problem of undesirable residues from chemicals used to treat infested grain.

Researchers at the Stored-Product Insects Research and Development Laboratory, Savannah, Ga., applied irradiation at each life stage of the beetle *Sitophagus hololeptoides*, a species that infests a variety of stored agricultural commodities. All stages—eggs, larvae, pupae, and adults—were subjected to seven radiation doses administered in a Cobalt-60 irradiator at 1.9 krad per minute. A krad, or kilorad, is a measure of the amount of energy absorbed per unit weight.

Doses ranging from 5 to 100 krad were administered to eggs 2 to 3 days old, larvae 42 to 49 days old, pupae 2 to 7 days old, and adults 3 to 5 days old. The treated insects were observed every 7 days until they died.

Researchers noted that although low levels of irradiation did not prevent egg hatch, the insects were damaged severely, sufficiently enough to prevent the development of adults.

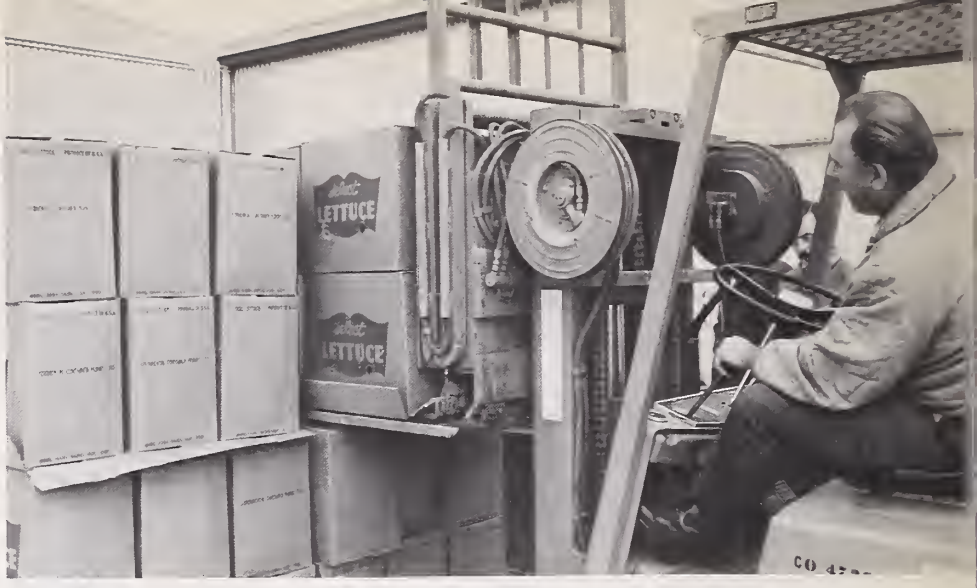
No mature larvae exposed to 5 krad pupated successfully. Untreated adults may live for several months.

All adults emerging from pupae treated with 5 krad or more were dead within 2 weeks. The greater the dose, the sooner all insects died. All adults treated with 10 or 20 krad were dead after 4 weeks; those treated with 30 krad by 3 weeks; and those with 50 or 100 krad by 2 weeks.

The U.S. Food and Drug Administration approves a level of 20 to 50 krad for the control of all stored-product insects in wheat and wheat flour. Research entomologist John H. Brower, at the Savannah laboratory, found the minimum legally allowable dose—20 to 25 krad—to be effective in radiation disinfestation to control *S. hololeptoides*. "Even 10 to 15 krad may be adequate for this species," Dr. Brower concluded.

Commercial application of gamma irradiation for controlling stored-product insects might be feasible if radiation facilities were incorporated into the construction of large grain handling facilities such as ports or terminals—a possibility for the future. □

The key to the unitized handling of lettuce is a slip sheet, which enables a forklift operator to pull an entire stack of lettuce cartons onto the forks by grasping the slip sheet. The stack can then be loaded directly onto a container truck or a refrigerated boxcar (0775X1095–23A).



Unitized handling cuts lettuce costs

BEN FRANKLIN didn't have in mind the packing and shipping of lettuce when he came up with his proverb, "a penny saved is a penny earned." But, in terms of more than 100 million cartons of lettuce shipped each year from California and Arizona fields alone, a penny saved per carton means something like a million dollars "earned" to growers and shippers.

Agricultural marketing specialists Russell H. Hinds and R. Tom Hinsch of the Market Quality and Transportation Research Laboratory, Fresno, Calif., are developing systems of packing and shipping that could save those millions of dollars in packaging materials and allow for unitized handling of lettuce cartons. Unitized handling—moving several cartons at once—would eliminate the back-breaking chore of lifting each individual carton at least five or six times.

Much lettuce is damaged by too much handling. Estimates are that as much as 7 percent of the lettuce arriving in New York is unusable because of poor or excessive handling.

Presently, lettuce is picked and trimmed in the field and packed in more or less flat cartons of two layers of 12 heads. These cartons go onto a 48 by 48-inch wooden pallet which is placed on a flatbed truck. When the truck is unloaded, the pallets are unloaded, by forklift and placed into a vacuum cooler.

Once out of the cooler, the cartons are unloaded by hand one at a time, placed on a conveyor belt, and stacked one at a time into a refrigerated truck or railcar. At the receiving end, the cartons are also unloaded by hand one at a time and repalletized for distribution.

The Fresno researchers are changing the shape and size of the carton. One of the experimental ARS cartons holds three layers of 8 heads. The "new" carton is shaped to fit onto a "pallet" size of 35 to 42 inches. That pallet configuration fits snugly two wide in a transport truck or three wide in a railcar.

Present pallets, when loaded, leave about 8 to 12 inches of unused space on the sides. Little is gained in the transport truck with the 35 by 42 inch size—when compared with the present hand-stacking method—but some 150 more cartons can be transported per railcar. The ARS carton also saves almost 8 cents per carton in lower paper and fabricating costs.

In a unitized handling system, lettuce cartons would be moved by hand only once—in the field, onto the truck. From then on the cartons would be handled by special forklift trucks until their final destination, the supermarket.

The most essential part of the experimental handling system is a "slip sheet"—a heavy piece of fiberboard material—that allows cartons to be handled just as they are on pallets. Slip sheets cost much less than pallets, and they allow stacks of cartons to be placed on top of each other. Heavy wooden pallets not only take up space, but can also damage cartons when stacked atop them.

To field test the slip sheet system, the Fresno researchers built a prototype "A" frame device down the center of a

Below: Mr. Hinds (standing in the field) positions a slip sheet on top of the plywood pallet. Using this method the truck can be unloaded by a single, large forklift hoisting the entire half of the truck load (0775X1095–28).

flatbed trailer. This allows angle stacking of cartons on the trailer similar to a beverage truck. The "A" frame, with its slight angle, allows the field workers to stack cartons along the straight-edge of the "A" frame and make an even stack, essential in unitized handling.

A smooth plywood pallet is positioned on the truckbed and a slip sheet is placed on the pallet. Cartons are then stacked on the slip sheet which can be removed readily from the pallet. Slip sheets overlap the cartons by 3 inches so that after the load has been removed from the vacuum cooler, a special forklift with a mechanical pincher takes hold of the overlapped slip sheet and pulls the stack onto the forklift.

Once on the forklift, the cartons are taken into the truck or railcar and loaded and stacked in the same manner.

Test runs have been made of the system in loading trucks and railcars for trips to Seattle from California and other test runs are scheduled for cities as far as Chicago, New York, and perhaps London. Many "bugs" are being worked out but the researchers are optimistic that the system will be ready when industry is ready to accept it.

Most supermarket warehouses are equipped with the special pincher type forklift since many products, such as canned goods, involve a similar system for unitized handling.

The Iceberg Lettuce Advisory Board is cooperating in the research. □

Below: Most supermarket warehouses are already equipped with forklifts with the special gripping device to handle unitized shipments (0775X-1095–21A).

Vaccination program provides protection against Newcastle

A TWO- OR THREE-STEP vaccination program gives a high level of protection to turkey poults against the virulent Asiatic or the exotic form of Newcastle disease.

In studies at the National Animal Disease Center, Ames, Iowa, a modified live-virus vaccine (B_1 type) commonly used against the domestic form of the disease prevented illness or death losses from Asiatic Newcastle for 10 months. Administration in the eye, practical in hatcheries, or in the drinking water, preferred by growers, was equally effective.

ARS veterinary medical officers William A. Boney, Jr., Henry D. Stone, and Kenneth G. Gillette and microbiologist Manuel F. Coria used 832 white turkey poults in the experiment. The poults had low-level passive immunity to Newcastle disease transmitted via the egg from vaccinated mothers. This immunity, though inadequate to protect against disease loss, sometimes prevents response to the first vaccination.

The experiment included seven variations in timing and method of administering the live B_1 vaccine, an experimental killed-virus vaccine, and unvaccinated controls. The study involved one, two, and three vaccinations with the B_1 virus at 4 days, 1 month, 4 months, or 5½ months, as well as two methods of administration. The vaccine prepared from killed virus (AGR. RES., Dec. 1970, p. 13) was administered subcutaneously at 4 and 80 days.

No deaths or symptoms of illness resulted from inoculation of turkeys with Asiatic Newcastle virus 1 to 10 months after vaccination. One, two, or three vaccinations with B_1 vaccine were similarly effective.

The researchers determined the level of protection afforded by the various vaccination schedules by hemagglutination tests when the poults were 1, 2, 3, 5, 8, and 10 months of age. The hemagglutination-inhibition titer, a measure of the inhibition of blood clumping in the test, declined with increasing time after vaccination. The titer for the group vaccinated only when 4 days old, for example, was 45.0 on the 28th day after vaccination but declined to 13.0 on the 56th day and 5.3 on the 84th day.

Vaccination at 4 days, or at 4 days and 1 month, and again at 4 months of age gave the highest level of protection against morbidity, mortality, and loss of egg production. The groups of poults on these schedules had hemagglutination-inhibition titers averaging 160.0 when 5 months old, and approximately one-half of that at 8 months when challenged to determine protection against loss of egg production. Those hens receiving two early doses of vaccine (4 days and 4 weeks) averaged one-third fewer eggs, whereas those getting a third (booster) dose at 4 months of age maintained egg production at 84 to 91 percent of their prechallenge levels.

This suggests, Dr. Boney says, that an early sensitizing dose plus a secondary or booster dose at 4 to 5 months of age is of prime importance in protecting market turkeys and birds to be kept for egg production. □

Research into turf nematode problems has led to a lusher "Plain" at the U.S. Military Academy, West Point, N.Y. Found infected with nematodes (as the photo on left shows, PN–2889), the grass showed marked improvements 4 months after being treated with an experimental nematicide (below, PN–2890).

Nematode problems on lawns

EXTENSIVE INVESTIGATIONS indicate that nematodes may be causing many more lawn and grass problems than experts have thought possible.

The new evidence was gathered from experiments on two famous lawns: The "Plain," the parade ground at the United States Military Academy, West Point, N.Y., and a large open area of Arlington National Cemetery in Virginia.

Nematologist Julius Feldmesser, Beltsville Agricultural Research Center (BARC), discovered and diagnosed symptoms of nematode damage—chlorosis, stunting, and bare spots in irregular patterns—on the Plain and then, with plant pathologist Stanley A. Ostazeski, of BARC's Field Crops Laboratory, detected the same kind of damage at Arlington Cemetery. Nematicidal treatments achieved greener grass on both during hot summer weather.

Various nematodes feed on grass roots. It has been difficult to evaluate the significance of nematodes as the cause of lawn problems because symptoms resemble those for other problems: Insects, fungi, and bacteria as well as improper watering or fertilization.

Soil and root samples, taken from the Plain confirmed Dr. Feldmesser's diagnosis. Nematologist A. Morgan Golden, also of BARC's nematology lab, found that the samples contained mixed populations of root-damaging spiral, stunt, and ring nematodes. Marginal areas, bordering green and brown (or bare) areas, had the highest numbers of these pathogenic organisms.

The damage had developed in hot August weather. According to Dr. Feldmesser, damage that can appear in Northeast turf in summer may be related to extensive nematode damage, similar to that known to occur in the Southeast.

On completing his diagnosis, Dr. Feldmesser treated the 9.3 acre Plain (except for small untreated, control plots) with 10 percent granular ethoprop, an experimental nematicide.

Four months later, sharply reduced nematode counts in the treated areas accompanied deeper green tones, more rapid grass growth, and filled-in bare spots.

As the result of this study, the Military Academy is now saving $1,200 to $1,700 a year in replacement of sod.

In addition to physically damaging roots, nematodes may create pathways for secondary invaders such as fungi and bacteria. "Even turf growers and contractors may not be fully aware of the importance of nematodes," says Dr. Feldmesser. "This is something that must be considered when lawn problems persist—when treatments for all other possible causes have failed."

At Arlington National Cemetery, the BARC scientists reduced chlorotic, brown, and bare patches on the large, sloping lawn between the Custis-Lee Mansion and the Kennedy grave site by diagnosis and treatment with the same nematicide used at West Point.

These nematode studies parallel earlier findings by Dr. Feldmesser and Dr. Golden which showed that nematodes caused browning of eight zoysia lawns and one bluegrass lawn in Maryland. Also, in cooperation with Dr. Ostazeski, they found mixed nematode populations on experimental bluegrass-zoysia plots at Beltsville.

In other research, the scientists sampled, at random, two 5,000 square foot areas of turf, one bluegrass, the other zoysia: a series of fescue pastures; and other mixed grasses and broad-leaf weeds growing in waste areas. All samples contained root-damaging nematodes. "They are so prevalent in grasses," Dr. Feldmesser said, "that we may not know what a nematode-free plot of lawn or grass looks like."

Beltsville research will soon expand to include the effects of nematodes on pasture and forage grasses.

Ethoprop is not registered with the Federal Government for the uses described here. □

Solid seeding soybeans

SOYBEAN GROWERS may be on the verge of making a major change in cultural practice—solid seeding in narrow rows.

It is possible to get a 10 to 20 percent increase in yields by shifting from rows of cultivatable width to rows that are spaced about 6 to 7 inches apart, says ARS agronomist Richard L. Cooper, Urbana, Ill.

But the chief bugaboo that has impeded general adoption of the solid-seeding system has been weed control. Farmers who have tried the system in fields without a history of serious weed infestations have been pleased with their results. New herbicides now entering the market may dispel the worries of growers who forego their option to cultivate.

Still, Dr. Cooper suggests that caution in adopting the solid-seeding system is justified. Dr. Cooper, who directs the U.S. Regional Soybean Laboratory at Urbana, began conducting research with solid seeding of soybeans in 1969. The research, done in cooperation with the Illinois Agricultural Experiment Station, grew out of his studies on early lodging in high-yield environments. If soybeans lodge in early to mid-August, they undergo physiological changes that impair setting of seed and filling of pods.

To avoid lodging and to fully realize the 10 to 20 percent yield advantage of solid seeding, Dr. Cooper advises against increasing the seeding rate per acre above that used with standard-width rows. In standard rows, natural thinning occurs where the seeds are planted closely together, he explains. In narrow rows, the plants are more evenly spaced, more equally competitive, and a larger plant population survives. In the larger populations, lodging is more serious, he says.

His studies show that about 1 bushel of viable seeds per acre is a nearly ideal planting rate for most varieties planted in 7-inch rows. That is about 150,000 seeds, or two seeds per foot of row.

The rate may be increased by one-half seed per foot of row (about 15 pounds per acre) in late plantings, Dr. Cooper says. He also recommends this increase when soybeans are planted on soils that normally do not yield more than 40 bushels per acre. On those soils, early lodging is generally not a serious problem. Because of a stand-establishment problem that may exist when a grain drill is used, the rate may also be increased by one-half or even 1 seed per foot of row.

But Dr. Cooper stresses avoiding the temptation to overseed. Rather, good stands should be established by using high-quality seed, developing a firm seedbed, and planting at a uniform depth. Tractor wheel tracks may make achieving uniform depth of seed placement difficult when a grain drill is used. However, the drill may be used in tandem behind a cultipacker to alleviate the problem.

Another alternative: planter units that can be mounted closely together on a tool bar. Before investing in more equipment, however, a grower can test his management skills with the solid-seeding system on a small acreage with his present row-planter equipment. He can plant at his normal row width and then double back over the land to split the middles of the rows, giving him narrow rows.

Dr. Cooper found that the early soybean varieties, Corsoy, Amsoy 71 and Beeson, responded to solid seeding with greater increases in yields than other varieties. Other varieties, which also responded well, were Wayne, Calland, and Williams. □

Protein found hiding in corn

A CORN PROTEIN that may have unexpected food value has been found hidden by a low-value protein, zein, both wrapped in a digestion-resisting membrane.

Corn endosperm, the starchy part of the kernel between the germ and the outer layers, contains protein bodies commonly regarded as the site of zein. Starch granules and zein bodies are held together by a protein cement or matrix.

Zein protein has a nutritionally poor balance of amino acids and dissolves in alcohol. Matrix protein has a better amino acid value and does not dissolve in alcohol.

Zein bodies are wrapped in a membrane that resists penetration by enzymes. It is a lipoprotein, a combination of protein and fat-like materials.

Slicing corn endosperm thinly enough to cut through the zein bodies, ARS scientists at the Northern Regional Research Center, Peoria, Ill., found that some protein in the bodies is not like zein. Chemist Michael J. Wolf, who is also a microscopist, and botanist Uheng Khoo studied the endosperm of ordinary and high-amylose corns.

"Both light and electron micrographs suggest that a large proportion of the total endosperm protein must be bound within the bodies," says Dr. Wolf. "Consequently the composition and availability of the alcohol-insoluble component of the bodies assumes nutritional importance."

The scientists found that the inner protein in the zein bodies is easily solubilized by a test proteolytic enzyme once the wrapping membrane is removed.

In earlier studies with Dr. Wolf and Dr. Khoo, chemists Donald D. Christianson, Harald C. Nielson, and Joseph S. Wall found that protein bodies from immature corn contain more of the essential amino acids, especially methionine, than can be accounted for by zein alone. Methionine is commonly in short supply in vegetable proteins.

Dr. Wolf thinks the favorable amino acid levels found for the whole zein bodies in immature corn may be due to the alcohol-insoluble protein that he and Dr. Khoo found inside the bodies. He adds, however, that zein bodies in mature corn may not be like those in immature corn in amino acid levels. He wants to isolate mature corn zein bodies to determine their protein composition and to find what happens to them in corn that is eaten. □

Sows spread TGE in farrowing houses

SOWS PROBABLY play a very important role in the explosive spread of transmissible gastroenteritis (TGE) when it strikes in a farrowing house.

TGE, a highly contagious virus disease, causes death losses approaching 100 percent in pigs less than 7 days old. The virus causes atrophy of villi, finger-like projections from the lining of the small intestine through which nutrients are absorbed (AGR. RES., March 1975, p. 12). Severe diarrhea, dehydration, and death usually result. Outbreaks are most common in winter and early spring.

Studies at the National Animal Disease Center, Ames, Iowa, indicate that susceptible sows in direct contact with sick pigs readily develop upper respiratory infection and may be a source of the virus for other susceptible pigs on the premises. TGE virus in the milk of some sows during the acute stage of illness may be an additional source of infection for their suckling pigs.

Little was known about how the TGE virus is spread after an outbreak when veterinary medical officer Lorant J. Kemeny, technician V. Leon Wiltsey, and electronic engineer Joseph L. Riley began their study. How TGE virus is perpetuated between outbreaks is still unknown. Dr. Kemeny suggests that the virus may exist in a latent state associated with upper respiratory infection in adult swine.

The researchers placed 10 sows from a specific-pathogen-free breeding herd in isolation units before farrowing. Each sow was left in contact with her pigs, which were infected orally with TGE virus when 2 or 3 days old. Pigs from all litters became ill, and 66 of the 71 pigs died of TGE within 2 to 8 days.

All sows became ill within 2 or 3 days after contact with their experimentally infected litters. TGE in adult swine is a mild, "flu-like" disease recognized only by close observation of poor appetite, elevated temperature, depression, and mild diarrhea for a few days. Dr. Kemeny suggests that TGE in many herds may remain undetected if susceptible newborn pigs are not present when the virus strikes older hogs.

TGE virus was readily isolated from the nasal secretions of sows during the first few days of illness—in one instance only 20 hours after contact exposure. Two sows had virus in their milk on the third or fourth day of illness.

At post-mortem examination, virus was more frequently isolated from tissues of the upper respiratory tract than from the small intestine. This indicated, says Dr. Kemeny, that the virus replicated in the upper respiratory tract, where it induced acute infection in susceptible sows. □

Many factors influence pond pollution

FERTILIZERS from agricultural lands have too often been blamed for nourishing the growth of algae in farm ponds and reservoirs. Recent research shows that the soils underlying these shallow bodies of water can be the sole source of nutrients for sustaining algae growth. Algae ruins the appearance of these ponds and reservoirs, often causing offensive odors, and restricting their use for recreation and irrigation.

ARS soil scientist Arthur R. Batchelder, Ft. Collins, Colo., initiated studies 5 years ago on the nutrient problems—first with green-house experiments and then with a series of small ponds.

He began with three soils from across the country: sandy loam from Georgia, silty clay loam from Nebraska, and loam from Colorado. In greenhouse studies, samples of each soil were packed 4 inches deep in the bottom of 17.5-gallon plastic cylinders. The cylinders were then filled with distilled water. Control containers were filled with nutrient solutions for comparison with the soil-water cylinders.

Two tests were then conducted, one lasting 219 days, the other, 270 days. After each filling with distilled water, algae began to grow and proliferate. Algae growth began within 2 weeks with the Georgia and Colorado soils and within 1 month with the Nebraska soil. The control began producing algae after 1 week.

"The initial algae, to start the growth, had to come from either air or the air-dried soils themselves. The different soils and control differed widely in water color, water turbidity, and algae types," said Dr. Batchelder. He also noted that total algae growth did not correspond to the content or concentration of nutrients in the soils before submersion or in the overlying waters after submergence.

Moving into the field, Dr. Batchelder began studying 18 small lakes, ponds, and irrigation reservoirs in the Ft. Collins area. They had various combinations of depth, surface area, times filled and emptied, and surrounding land use. The smallest was three-fourths of an acre and the largest 1,580 acres.

As in the greenhouse studies, he found that no single factor provided satisfactory guidelines for predicting how much of a problem algae will be in different ponds. Concentrations of inorganic nitrogen, however, were more reliable than those of phosphate for estimating algae growth. These two nutrients are currently used as predictors.

"It is difficult to specify any one factor—such as agricultural runoff—that causes algae growth: there are just too many physical and chemical variables involved. More recent research shows that interrelationships exist among the concentrations and ratios of calcium, magnesium, and sodium for predicting algae growth," Dr. Batchelder says. □

AGRISEARCH NOTES

Super-male boll weevils

"SUPER-MALES" in the insect world are not to be taken lightly. Scientists at the Boll Weevil Research Laboratory coined the word for weevils which produced the most—and most potent—pheromone. This sex attractant or pheremone called grandlure, is derived from the insects' frass or excrement, and is widely and effectively used as bait to trap female boll weevils.

Screening of males for pheromone production is part of the on-going boll weevil eradication research at Mississippi State, Miss. At the Boll Weevil Research Laboratory, 100 male weevils from the Pee Dee Experiment Station, Florence, S.C., were divided into two groups of 50 and compared with an equal number of ebony strain males from the Gast Rearing Laboratory, Mississippi State. Frass was collected daily and extracted in 3-day accumulations.

The Florence weevils produced significantly more grandlure, 1.478 micrograms per male per day, than the ebony weevils, 0.684 micrograms per male per day. Frass production for the Florence weevils was only slightly greater: 1.064 milligrams per male per day compared to 0.909 milligram per male per day for the ebony weevils.

If a male weevil is not naturally a "super" pheromone producer he can be made that way. Researchers added grandlure-impregnated paint to the insects' elytra, the protective wing covers which shield the functional wings. Small dots of "butyrate dope" containing grandlure placed on the weevils significantly increased the attractiveness of sterile males to females.

When 1, 2, 3, and 4 dots of grandlure-impregnated dope were placed on aluminum strips rather than on weevils in laboratory tests, the scientists found that the females were attracted to the pheromone spots for 5 days. Similar results have been obtained when pheromone-impregnated dope was placed on male and female weevils in laboratory tests.

Entomologists Gerald H. McKibben and William L. McGovern conducted the boll weevil screening tests for selecting super-males. Entomologists Earl B. Mitchell, Marvin E. Merkl, and biological technician Nevie N. Wilson increased the attractancy of males with grandlure-impregnated dope.

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Odor from jute sacks

JUTE SACKS have a characteristic odor but nevertheless are used to store and transport various foods, especially dry legumes and grains. In connection with other studies over several years, chemists at the Western Regional Research Center, Berkeley, Calif., have detected chemicals in several farm products that are also found in jute sacks.

By employing several testing techniques, including capillary gas chromatography and mass spectrometry, chemists Ron G. Buttery, Dante G. Guadagni, and Richard M. Seifert, pieced together the relationship of the chemicals in jute sacks and the presence of these chemicals in foods.

Hydrocarbons, such as dimethylnaphthalenes, apparently originate from the mineral oil used in manufacturing jute yarn. Phenolic compounds may also originate from the mineral oil, may be added separately in some form of preservative, or may result from a breakdown of lignin in the fibers. Aliphatic aldehydes and alcohols may originate from the jute plant itself.

"It's possible that the sacks could transfer enough of these chemicals to adversely affect the flavor and odor of foods stored in the sacks. Naturally, the food immediately in contact with the sack would be expected to be more tainted," Mr. Seifert says.

Although these levels of chemicals are borderline, Mr. Seifert points out that under various conditions the levels become high enough to cause off-flavor problems. These conditions include longer storage times, higher temperatures, and increased exposure to the sun. In addition, bags that get wet, as occasionally happens in normal usage, produce a much more unpleasant odor than do dry sacks.

This research also indicates that less odor would be transferred to foods if the manufacturers of jute sacks used a completely non-aromatic mineral oil for processing jute.

New clover variety

SEED OF A NEW red clover variety, Arlington, that is resistant to the disease, northern anthracnose, may be available for farmers who plan to grow the variety as forage in 1976.

Plants of varieties that are susceptible to northern anthracnose may lose many of their leaves, and some plants weaken and die with the disease, says ARS plant geneticist Richard R. Smith, Madison, Wis. Because of its excellent resistance to the disease, Arlington may become popular where it is adapted, he says.

Arlington is adapted for forage production in north central and northeastern United States and south central Canada. Scientists of ARS and the Wisconsin Agricultural Experiment Station cooperated in development of the new variety.

Also incorporating excellent resistance to another disease, powdery mildew, Arlington is a variety that should consistently produce good seed yields, especially in the western region of the United States where much of the Nation's forage seed is grown.

Forage yields of Arlington equalled or exceeded those yields of other adapted red clover strains in experiments in north central United States and south central Canada.

In tests for digestibility of dry matter, the researchers found Arlington comparable to the varieties Lakeland and Dollard. Outyielding these two varieties, Arlington produced as much protein per acre as Dollard and more than Lakeland.

Wisconsin scientists who participated in developing Arlington included emeritus professor William K. Smith and plant pathologists Douglas P. Maxwell and Earle W. Hanson.

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